THURSDAY, AUGUST 28, 1873

## *THE REPORT OF THE SCIENCE COMMISSION ON THE OLD UNIVERSITIES*

### II.

IN relation to the Colleges, the attention of the Commissioners has been principally directed to the following points:—1. The Scholarships. 2. The Fellowships. 3. The Organisation of the Instruction given in the Colleges in relation to the Instruction given in the Universities. 4. Contributions from the Colleges to a fund for University purposes.

After giving a list of the Scholarships filled up in Oxford from January to December 1872, it is remarked that "it is evident upon a comparison of the numbers contained in this list that the Scholarships offered for Natural Science are but a small fraction of the whole number. The state of the case appears to be that the Colleges do not offer Scholarships for Natural Science because they fear they would not get good candidates from the schools; and the schools do not teach Natural Science because they are afraid of injuring the prospects of their pupils by diminishing their chances of obtaining a Scholarship. It cannot be doubted that the effect upon the schools of this unequal distribution of rewards has been, and is, very discouraging to scientific study; and that it has exerted a most unfavourable influence upon the number of Natural Science students."

Without being prepared to concur in this estimate of the relative value of the two objects, we are nevertheless of opinion that it is of great importance, with the view of promoting the study of Natural Science in the first grade schools throughout the country, that there should be an immediate, and ultimately a large, increase in the number of Scholarships offered for this subject by the Colleges.

The part of the report which deals with the Fellowships is of great importance.

After quoting from the evidence of the Chancellor of the University of Oxford and others, evidence to the effect that the present application of the revenues to Fellowships is exceedingly unsatisfactory, the report proceeds:—

"Whilst giving every weight to the considerations urged by Prof. Jowett, and admitting to the fullest extent the great stimulus which the higher education has received at Oxford from the system of election to Fellowships by open competition, we are nevertheless satisfied by the evidence laid before us that an unduly large proportion of the revenues of the Colleges is expended in sinecure Fellowships; and we have reason to believe that this opinion is shared by a large and increasing number of the resident members of both Universities. . . .

"It is doubtless advantageous to the country at large, as has been urged by some of our witnesses, that young men of ability, who choose to enter into one of the great professions, should be supported, or nearly so, in the early years of their professional career, and thereby be enabled to apply themselves at once to the higher studies of their profession, instead of wasting their energies in drudgery of some kind, for the mere purpose of obtaining a temporary livelihood. But this end may be secured by means of Fellowships tenable only for a limited period. It has been urged that the feeling of security given by the system of unlimited tenure greatly enhances the value of a Fellowship. No doubt it is a very comfortable thing for a young man to feel that, come what may, he is secure of an income so long as he chooses to remain single. But we can see no adequate reason why he should be thus comforted at the expense of the College, when he has preferred the more attractive prospect of a professional career in the outer world to the work of the College. . . .

"We are therefore decidedly of opinion that the Fellowships awarded as prizes are excessive in number if not in value, and that the system ought to be remodelled. We are further of opinion that in any such remodelling a considerable proportion of the Fellowships should be suppressed or consolidated for the purposes of contributing to the general fund of the University and of endowing, within the Colleges and the University, new institutions, new offices, in aid of education or research. But it must be remembered that, as Prof. Jowett has stated, the property of the Colleges at Oxford, in some instances at least is greatly increasing, so that quite independently of the suppression of Fellowships there will in all probability be considerable sums available for these purposes. In any case, therefore, we are prepared to admit that a great part of the Fellowships ought to be retained as Fellowships, and the problem that has to be solved is how to employ those which are so retained in the most useful manner possible.

"The following are the chief purposes to which, in our judgment, the Fellowships should be applied:—

"In the first place, a certain but not a very large proportion of the Fellowships will be always required, as at present, for the payment of the persons entrusted with the management of the College estates, and with the government and administration of the Colleges themselves.

"Secondly, a large number of the Fellowships is at present employed, and probably a still larger number ought hereafter to be employed, in connection with the instruction given in the Colleges.

"Thirdly, a smaller, but still a considerable number of Fellowships ought to be employed as Terminable Prize Fellowships.

"Fourthly, a certain number of Fellowships ought, as we have already said, to be united with Professorships in the University; the University professor becoming *ex officio* a Fellow of the College and a member of its governing body.

"Lastly, it is, in our opinion, most important that a certain number of Fellowships should be appropriated to the direct promotion of learning and research in various directions. It has been objected to this proposal that the Fellowship system, as hitherto administered, has not shown any great tendency to encourage original research, either in the field of learning or in that of Science; that, when an office is created simply and solely with the view of giving a man leisure and opportunity for original research, there is always the appearance, to say the least, of creating a sinecure; and that it is impossible, as Prof. Jowett has said, to get a man for money who can make a discovery. But, though you cannot get a man for money to make a discovery, you may enable a man who has shown a special capacity for research to exert his powers; and we are of opinion that, unless an effort is made to do this, one of the great purposes for which learned bodies, such as the Colleges, exist, may run the risk of being wholly lost sight of. Scientific discoveries rarely bring any direct profit to their authors, nor is it desirable that original investigation should be undertaken with a view to immediate pecuniary results. 'Research,' as Lord Salisbury has observed, is 'unremunerative; it is highly desirable for the community that it be pursued, and, therefore, the community must be content that funds should be set aside to be given, without any immediate and calculable return in work, to those by whom the research is to be pursued.'

"It may be that properly qualified candidates for such scientific offices would not at first be numerous, but we believe that eventually a considerable number of Fellowships might be advantageously devoted to the encouragement of original research.

"We think that such Fellowships as might be expressly destined for the advancement of Science and Learning should only be conferred on men who by their successful labours have already given proof of their earnest desire, and of their ability, to promote knowledge; and we believe that appointments, made with a due regard to this principle, would be abundantly justified by results. A man who has once acquired the habit of original scientific work, is very unlikely ever to lose it, excepting through a total failure of his health and strength; and even if it occasionally happened that a Fellowship awarded on the grounds of merit, as shown in original research, should only contribute to the comfort of the declining years of an eminent man of science, there are many persons who would feel that it could not have been better expended in any other way.

"We should not wish to attach any educational duties properly so called to a Fellowship awarded with a view of encouraging original research in Science. But for many reasons we should think it desirable that the holder of such a Fellowship should be expected to give an account, from time to time, in the form of public discourses, of the most recent researches [in his own department of Science."

The last section of the Report dealing with the duty of the Universities and Colleges with regard to the advancement of Science is so important that we give it at length:—

" *Research a primary Duty of the Universities*

"On no point are the witnesses whom we have examined more united than they are in the expression of the feeling that it is a primary duty of the Universities to assist in the Advancement of Learning and Science, and not to be content with the position of merely educational bodies. We entirely concur with the impression thus conveyed to us by the evidence, and we are of opinion that the subject is one to which it is impossible to call attention too strongly. We think that if the Universities should fail to recognise the duty of promoting original research, they would be in danger of ceasing to be centres of intellectual activity, and a means of advancing Science would be lost sight of which, in this country, would not easily be supplied in any other way. There is no doubt that at the present time there is a very strong feeling in the country in favour of the wide diffusion of education, and of the improvement of all arrangements and appliances which tend to promote it, from the simplest forms of primary instruction up to the most advanced teaching that can be given in an University. But there is some reason to believe that the preservation and increase of knowledge are objects which are not as generally appreciated by the public, and of which the importance is not so widely felt as it should be. On this point we would direct especial attention to the remarks of Sir Benjamin Brodie: 'For education we construct an elaborate and costly machinery, and are willing, for this end, to make sacrifices: but, on the other hand, the far more difficult task of extending knowledge is left to the care of individuals, to be accomplished as it may; and yet it is this alone which renders education itself possible. I really am inclined to think that in former days a more real and earnest desire must have existed to preserve knowledge as a valuable national commodity for its own sake than exists now; and the reason that I say this is, that we have existing in the Universities of Oxford and Cambridge records of another condition of things with regard to knowledge than that which exists at present. In the first place we have extensive libraries which could only have been founded and preserved for the sake of the preservation of knowledge itself; and in the next place the collegiate foundations in the Universities were originally and fundamentally, although not absolutely and entirely, destined for the same objects. . . . This object is certainly not less important in modern than in ancient society. I presume that in the middle ages knowledge would altogether have perished if it had not been for such foundations, and it appears that now from other causes the pursuit of knowledge and of general scientific investigation is subject to very real dangers, though of another kind to those which then prevailed, and which make it very desirable for us to preserve any institutions through which scientific discovery and the investigation of truth may be promoted. . The dangers to which I refer are dangers which arise partly even from the growing perception of the practical importance of knowledge, which causes a very great draught indeed to be made upon the scientific intelligence of the country. In the first place, almost every scientific man is caught up instantly for educational purposes, for the object of teaching alone; and, in the next place, a very great draught indeed is made upon Science for economical purposes; I mean for purposes connected with practical life. In sanitary matters we have numerous examples of the vast amount of work done by scientific men for public and practical objects. So that the supply of scientific men is not equal to the demand for those objects alone. Manufactures offer another great field of scientific employment, and it is to [be observed that these are the only ways through which an income can be obtained, the pursuit of scientific truth being an absolutely unremunerative occupation.'

"We believe that the dangers referred to in these remarks are real; and their existence induces us to lay down, as emphatically as possible, the position that the promotion of original work in Science should be regarded as one of the main functions of the Universities, and should be specially incumbent upon the holders of those fellowships which, as we have already recommended, should be awarded with a view to encouraging original research. As regards the professors, we have already insisted on the importance of so arranging their duties as to give them abundant leisure, and, what is no less indispensable, abundant opportunities for original investigation, by providing the external appliances necessary for it. We think that the great national interests connected with the advancement of Science form one, although only one, of the grounds upon which the endowment of professorial offices is defensible, and regard it as a great advantage that an opportunity is afforded by the peculiar circumstances of the Universities of giving encouragement and maintenance to a class of persons who are competent to advance Science, and who are willing to make its advancement the principal business of their lives.

"We have already stated, but we would repeat it here, that we would on no account have offices founded within the Universities without special duties attached to them. It is an absolute advantage, if not in all, at least in many cases, to a man who is engaged in some abstract part of Science, to be compelled to produce, in the form of public discourses, the results of his labours; and it can be no disadvantage to him, under any circumstances, to be obliged to devote some moderate part of his time to showing, if it were only by the example of his own work, to younger men, how scientific studies should be carried on with the view of promoting human knowledge. We believe that in all ordinary cases a certain amount of educational work is of advantage to the scientific worker, and we also believe that for the promotion of the highest scientific education it is very desirable to bring the original worker into direct personal contact with the student.

"We have also already spoken of the propriety of awarding Fellowships in certain instances, not, as at present, by an examination test, but for services rendered to Science in Original Research. Although we should wish, as we have already said, to see this done from time to time (as it has already been done at Cambridge) in the case of persons who have already made themselves eminent in Science, and whose accepting the Fellowship is rather to confer an honour upon the office than to receive one from it, we also think that a wider application should be given to this principle; and, that whenever a Fellowship in Natural Science is offered for competition among the younger Graduates of the University, such evidence as any candidate can offer of his aptitude to become an useful worker in Science, should always be taken into account in the award. Nothing, we believe, would tend to give the students at the Universities so just an idea of what Science is, or of what the objects are which those who pursue it should have in view, as the adoption of the principle by the Universities and the Colleges, that the highest honours and rewards in Natural Science are to be conferred upon men who can offer some evidence that their names are likely afterwards to find a place on the list of those who have added to human knowledge.

"The proposals to which we attach the most importance with a view to the encouragement of Original Research at the Universities are the two to which we have just referred: (1) the establishment of a complete Scientific Professoriate; (2) the appropriation, under certain conditions, of Fellowships to the maintenance of persons engaged in Original Research. But, in addition to these main proposals, other suggestions are contained in the evidence before us, to which we would call especial attention: (1) that Laboratories should be founded expressly intended for Research, and for the Training of Advanced Students in the methods of research; (2) that Scientific Museums and Collections should be maintained to an extent beyond what is required for purely educational purposes; (3) that a Doctorate in Science should be instituted.

"*Proposed Laboratories for Research*

"It is one of the disadvantages of an University course that a young man, up to the time of taking his degree, is straining every nerve in order to master a certain amount of knowledge in which he has to pass an examination; and however improving this process may be to him in certain respects, the impression is widely entertained that it is not caculated to develope the originality of his mind, or those peculiar qualities which fit a man to become a discoverer in Science. As it is indispensably necessary that the student should be well grounded in his work, and should have a thorough comprehension of the methods and principles of his branch of Science, before he attempts to add to it, it is not easy to see how this disadvantage could be remedied during his undergraduate course; but as soon as his examinations are passed, it is surely time that he should be led to regard his studies from another point of view, and to give them a different direction. He should then be placed in a laboratory devoted to original research, and under the immediate care of persons who are principally engaged in work of that nature.

"On this point we would again refer to the evidence of Sir Benjamin Brodie: 'I should like (speaking of my own department and departments which are cognate with it, and I have no doubt that the same remark would also apply to Physiology and to other subjects) to see those professors have under their control laboratories suited for scientific research and investigation, in which they should take a certain limited number of students who would work, partly as their pupils and partly as their assistants, for those ends. And I should myself say that this is an educational function of the most important character possible, because you would here really carry scientific education to its end. If you do not do this you stop short of the most important part of all in scientific education. Now the real perfection of Science is shown only in scientific inquiry—the perfection of Science not only in its general results, but the perfection of Science as an instrument for education; and if you leave out in the University system any provision for scientific research, you are leaving out the most important feature of the subject. Those pupils would be persons who would ultimately pursue the science as their main business in life, and become in their turn the teachers and the professors of the subject. I am not giving a mere chimera or dream, but this is already, though not exactly in the way that I am suggesting, carried out to a great extent in Germany.'

"No less important, as giving one view of this question, is the evidence which we have received from Dr. Frankland, who says, 'In my opinion the cause of this slow progress of original research (in England) depends, in the first place, upon the want of suitable buildings for conducting the necessary experiments connected with research; secondly upon the want of funds to defray the expenses of those inquiries, these expenses being sometimes very considerable; but, thirdly and chiefly, I believe that the cause lies in the entire non-recognition of original research by any of our Universities. Even the University of London, which has been foremost in advancing instruction in experimental Science, gives its highest degree in Science without requiring any proof that the candidate possesses the faculty of original research, or is competent to extend the boundaries of the science in which he graduates. I consider that this circumstance is the one which chiefly affects the progress of research in this country, because if we inquire into the origin of those numerous Memoirs upon original investigations that come from Germany, we find that a considerable proportion of them are investigations made by men who are going in for their Science degrees, and who are compelled, in the first instance, to make those investigations, and they attain by that means the faculty and liking for original research, and frequently follow it out afterwards; so that a considerable proportion of the papers themselves are contributed in the first place by those men going in for degrees, and a considerable proportion of the remainder are obtained, I believe, through the influence of this previous training in research upon the men who have taken the degrees. Further, the entire ignoring of research in the giving of degrees in this country diverts also, or has a tendency to divert, the attention of the professors and teachers in this country from original research. They have not to take it into their consideration in the training of their students; they have not to devise, as is the case in Germany, suitable subjects for research to be pursued by their students; and thus their attention is, as it were, taken away entirely from this highest field of Science. And, indeed, if they themselves devote some of their time to original research, it almost appears to them to be a neglect of their class duties because their class duties do not require it. Their students are to be trained for subjects which are foreign to original research; they are to be trained chiefly in subjects that are to be taught by lectures, and by what I should call "descriptive," as distinguished from "experimental" or "practical" teaching; and, consequently, I think that in both ways—both by not bringing students into contact with original experimental work, and by diverting the attention of the teachers and professors in this country from such work, great damage is done to the progress of investigation in Great Britain by the attitude of our Universities.'

"Sir William Thomson has gone even further, and has expressed an opinion that the systems of examination in the Universities, as at present arranged, so far from doing anything to encourage the spirit of scientific research, have an exactly opposite tendency. 'That, to some degree, competitive examinations produce an elementary smattering of Science I have no doubt whatever, but I cannot see that they produce much beneficial influence; and in the higher parts especially, they have, I fear, a very fatally injurious tendency in obstructing the progress of Science.'

"The kind of assistance which we should desire to see given in the English Universities to young men who have completed their university course, and who propose to adopt a scientific career, has been from time to time afforded at various institutions in the United Kingdom, among which we may particularly mention the Laboratory of the University of Glasgow, under the direction of Sir W. Thomson. The plan has been adopted in some of the German Universities, and even in the great Polytechnic Schools of that country. In France it has recently been organised on a most complete and extensive scale. The École Pratique des Hautes Études is a Government Institution of which the object is to encourage young men to devote themselves to scientific research, and to give them opportunities of learning its methods. The course pursued by this institution is to take young men who have completed their preliminary scientific studies, and, allowing them an annual stipend to defray the expenses of their maintenance, to place them under the care of competent professors, who give them assistance and advice in their first researches, and to whom they afterwards become useful. This plan appears to us so excellent in itself, and at the same time so academic in its general character, that we desire to recommend it for adoption at Oxford and Cambridge. To insure due attention to both classes of students, it would be proper that the laboratories intended for training in the methods of research should be distinct from those in which more elementary instruction is given.

"We are also of opinion that arrangements should be made in some of the public buildings of the Universities, for giving opportunities to members of the Universities, no longer *in statu pupillari*, of prosecuting researches; although we should regard it of primary importance that these arrangements should be such as not to interfere with the teaching duties, or with the scientific work, of the professors. We agree with Dr. Frankland that one 'cause of the slow progress of original research' in England is 'the want of suitable buildings for conducting the necessary experiments connected with research;' and we think that the Universities might, with great propriety, supply this want, so far as their own members are concerned. We also think that collections of apparatus should be formed, which would be available for the use of such independent workers in Science. There are some obvious difficulties involved in this plan, which has been strongly recommended by some of our witnesses, but which, so far as we are aware, has not been anywhere practically tried. We should, however, look with confidence to such a body as the proposed 'University Council of Science' to frame suitable regulations as to the fitness of the persons admitted to the privilege of working in an University laboratory, and as to the securities to be taken for proper care in the use of valuable instruments. We are disposed to think that, under the special circumstances of the Universities, they would do more to promote original work by offering facilities of the kind which we have described than by making grants of money similar to those which are made in aid of special researches by the Government Grant Committee of the Royal Society. The plan would have the collateral advantage of rendering residence at the Universities attractive to scientific men.

"*Proposed Special Scientific Collections*

"Although we think it desirable that Scientific Museums and Collections should be maintained in the Universities to an extent which would render them available for original research, as well as for the purposes of education, we do not attach the same importance to this point as to the preceding, because museums and collections have been formed and will be formed in other places than in Universities, whereas laboratories adapted for the instruction of students in the methods of scientific investigation are not likely to be founded except in connection with educational institutions; and although it is a disadvantage to a scientific man not to have all the collections that he desires immediately at his hand, yet, considering the proximity of the Universities to London, it cannot be said that this disadvantage amounts to more than an inconvenience.

"We also are of opinion that it is very desirable that such more extensive collections as may be formed in the Universities should, as far as possible, be kept separate from the more limited collections intended for educational purposes. A Museum may be very easily made too large for these purposes, and instead of giving the student clearer ideas, may serve to confuse him.

"*Proposed Doctorate in Science*

"We have already referred to the possibility of instituting Higher Degrees, to be conferred upon students, not in accordance with the results of an examination, but upon their giving proof of capacity for original research. The evidence of Dr. Frankland and of Sir William Thomson, which we have already quoted, and to which we might add that of the late Prof. Rankine, appears to us conclusive upon the point that there is a real danger in the examination system; and in our opinion this danger might be guarded against by instituting a higher degree in Science, the obtaining of which should be regarded as a great honour, and which should not be awarded except with reference to original work. The plan of requiring from a candidate for the Doctorate in Science a dissertation embodying an account of some original research of his own is strongly approved by such competent witnesses as Dr. Siemens, Dr. Carpenter, and Prof. Frankland. This plan has been adopted in several of the German Universities, and has now become the established rule in France."

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## *METEOROLOGICAL CONFERENCE AT LEIPSIG DURING AUGUST* 1872[*]

Of the Congresses which have recently been held, none were more urgently called for than an International Congress of Meteorologists. Doubtless even under the diverse systems of observation which have been in use at national observatories and among meteorologists of different countries, large and valuable contributions have been made to Climatology and other departments of Meteorology. We need only refer to the various charts which have been published, showing the geographical distribution of atmospheric and oceanic temperature, of atmospheric pressure, of humidity, of prevailing winds, and of rainfall, and to the enormous amount of materials now being amassed, illustrative of the nature and course of storms, to show the important results which have been obtained. It must, however, be confessed that, as respects nearly the whole of this information, it can be regarded as valuable only in the sense of its being sufficiently approximate so as to meet the requirements of some of the more pressing practical questions of the science, and not because it is precise.

It is when we attempt inquiries into such questions as the diurnal and annual march of the different meteorological elements, and the relations of these elements *inter se*, and of weather on a large scale, that the general unsatisfactoriness of the systems by which observations are made in different countries comes to be forcibly felt, owing to their want of precision and uniformity. The want of uniformity is most conspicuous as respects temperature, humidity, and wind—or just those fundamental facts which must be scientifically observed and discussed before we can hope to solve the problem of weather changes.

In order to bring about a greater uniformity of procedure in different countries, it was proposed to hold a Meteorological Congress at Vienna in 1874. In June last, Bruhns of Leipsig, Wild of St. Petersburg, and Jelinek of Vienna, issued an invitation to meteorologists to attend a preliminary conference to be held at Leipsig in August, for the purpose of preparing the programme for the Vienna Congress, to instigate preparatory experiments on some of the more important questions, and thereby render it possible for the Congress to arrive at immediate conclusions on many points. The Conference was thus only consultative. Accompanying the invitation were a series of twenty-six questions, which it was proposed to submit to the consideration of the Conference.

Upwards of fifty persons attended the meetings of the Conference, which lasted three days. The opinions of the different speakers on the points raised by the 26 questions are detailed in the pamphlet before us, which contains also the written opinions of 14 meteorologists who were unable to be present, including the well-known names of Dove, Rubenson, Mohn, Mühry, and Wolf, as well as the results of the deliberations of the French meteorologists at Bordeaux in September. The subjects treated of may be conveniently classed under the heads of instruments, their position, the methods of discussing, publishing, and utilising the observations.

*Barometers.*—To those who have attempted to discuss weather, it is well known that nothing exact or satisfactory need be looked for in the result, unless observations from numerous barometers well distributed be available. It is thus desirable that barometers be procurable at a moderate price for stations of the second order. Are Board of Trade barometers—barometers fitted with a float—or aneroids, suited for such stations; or is there any other cheap form of barometer that would serve the purpose? After a lengthened discussion it was referred to Dr. Hann of Vienna to prepare a report for the Vienna Congress. The most diverse opinions were expressed regarding the aneroid, arising probably from the experience of the different writers and speakers—some aneroids going well for years with no permanent alterations occur-

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[*] Report of the Proceedings of the Meteorological Conference at Leipsig. Protocols and Appendices. Translated from the Official Report, Appendix to Vol. vii. of the "Zeitschrift für Meteorologie." Published by the authority of the Meteorological Committee. London, 1873.